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(56) Documents Cited

GB 2283902 A

GB 2004177 A

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(54) Body armour

(57) Body armour 10 for use in protecting a protected side 12 thereof from a stabbing threat comprises first 16 and second 18 layers of platelets overlying a flexible sheet 20. The platelets 22 forming said first layer 16 comprise first protective portions 22a being arranged adjacent to each other in a two dimensional array which substantially covers the area of said armour. Each platelet 22 also comprises a second protective portion 22b which covers the gap between adjacent first protective portions 22a. The inner platelets 26 are positioned to intercept stabbing threats 30 passing between the outer platelets 22 obliquely.

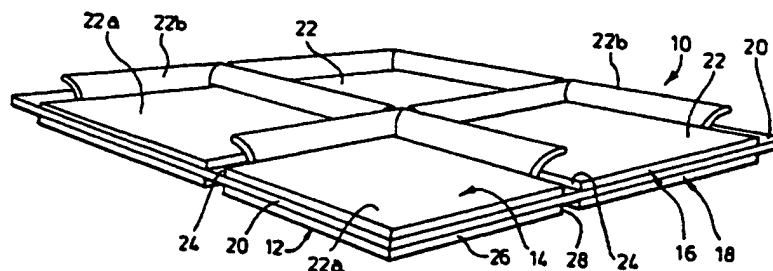


FIG. 1

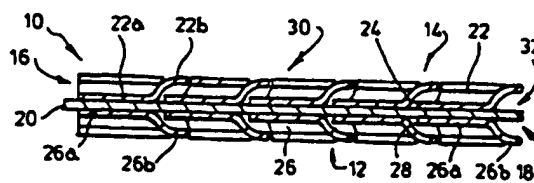


FIG. 3

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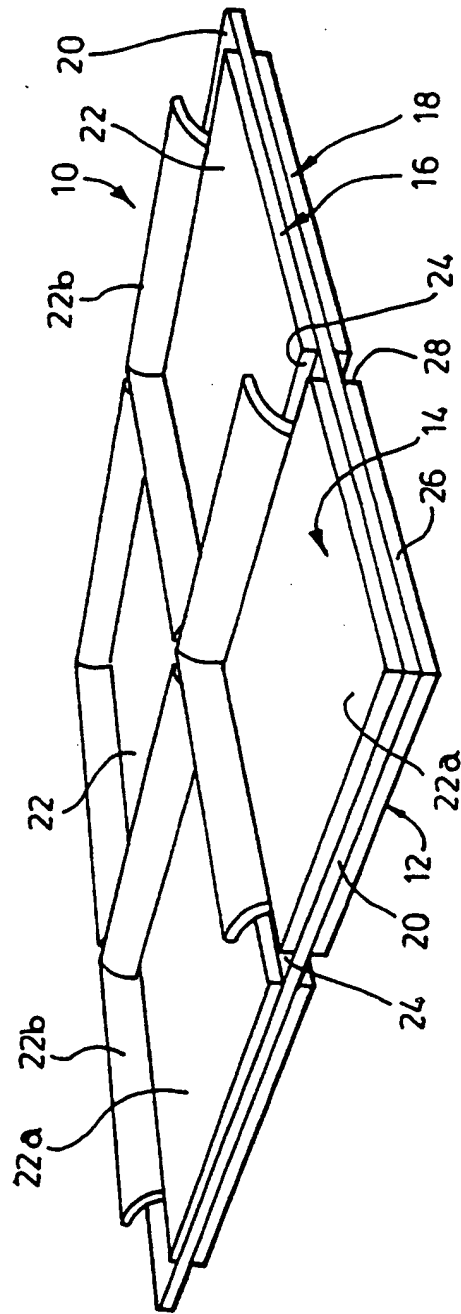


FIG. 1

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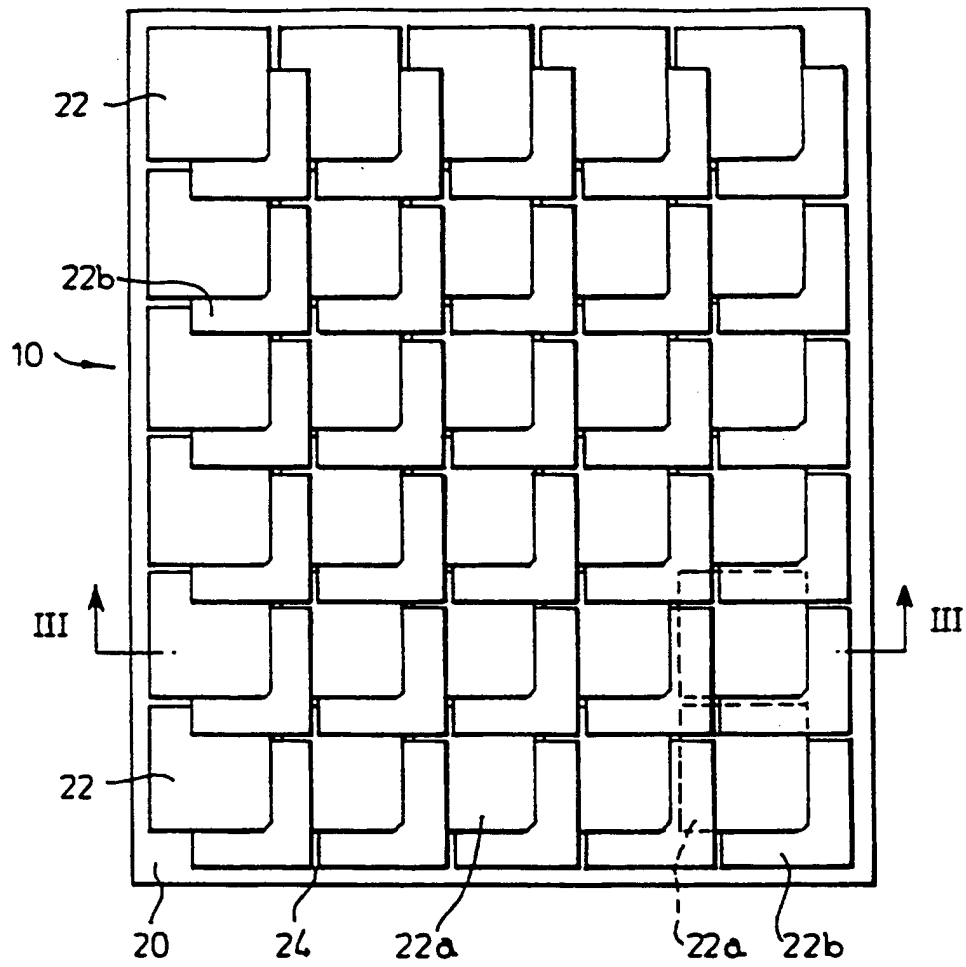


FIG. 2

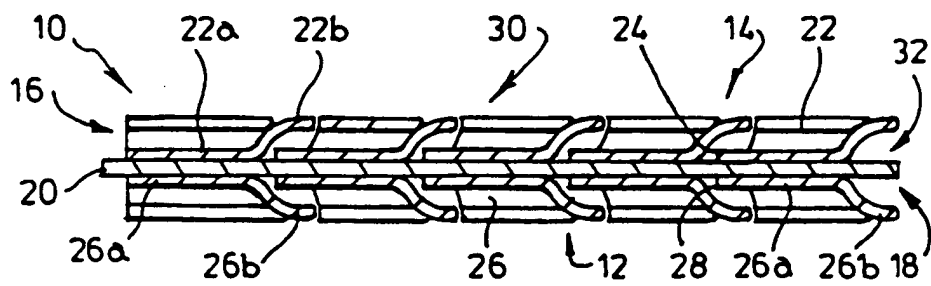


FIG. 3

## ARMOUR

This invention is concerned with armour, especially armour which is intended to provide protection against stabbing threats from knives or similar weapons. Such armour can be utilised in jackets which may, or may not, also comprise anti-ballistic protection to prevent injury from bullets.

Armour for protection against stabbing threats has to prevent substantial penetration by a knife, has to be sufficiently flexible that the wearer can manoeuvre, and has to be light so that the wearer is able to wear it for long periods. There are designs of armour which meet these criteria to varying degrees but none is entirely satisfactory. For example, GB 2 283 902 A discloses designs of armour having one or two layers of platelets which are mounted by fasteners on sheets of flexible material. These designs attempt to cover the gaps between square or rectangular platelets in a layer either by utilising a further layer of platelets (the platelets in the further layer being offset from those in the first layer) or by utilising flanges of the platelets which underlie edges of adjacent platelets. Thus, the platelets which have flanges can be considered to comprise a first protective portion which lies substantially in a first plane and which, in plan view, has a square or a rectangular shape, and a second protective portion covers the gaps between the first protective portions. These platelets are arranged so that their first protective portions are adjacent to one another and form a two-dimensional rectilinear array and said second protective portions project beyond one or more edges of the first protective portion and beneath the edge of the first protective portion of at least one adjacent platelet, ie the second protective portions are on the protected side of

the armour as opposed to the threat side thereof. This design is, however, found not to be sufficiently flexible as a result of binding between adjacent platelets and the protection afforded thereby is insufficient as it is vulnerable to a threat travelling obliquely of the plane of the platelets passing between the platelets.

An object of the present invention is to provide an improved armour for protection against stabbing threats which does not have the above-mentioned disadvantages.

The invention provides armour for use in protecting a protected side thereof from a stabbing threat originating on an opposite threat side of the armour, the armour comprising first and second overlying layers of platelets, the first layer lying nearer to said threat side than the second layer, wherein the platelets forming said first layer each comprise a first generally planar protective portion, the first protective portions being arranged adjacent to one another in a two-dimensional array which substantially covers the area of said armour, wherein each platelet forming said first layer also comprises a second protective portion which is integral with said first protective portion of the platelet, the second protective portion projecting in a plane generally parallel to the plane of the first protective portion over an edge of the first protective portion of at least one adjacent platelet in the first layer, the second protective portions of the platelets in the first layer being arranged so that they are adjacent to one another and co-operate in forming a cover overlying on the threat side substantially all of the gaps between the first protective portions, and wherein the platelets in the second layer are positioned to intercept stabbing threats passing between the platelets of the first layer obliquely of the layers, and wherein the platelets in the two layers are secured in their relative positions by being mounted on one or more sheets of flexible material.

In armour according to the invention, the disadvantages of the above-mentioned designs are overcome. Firstly, the second protective portions are on the threat side and hence are not as likely to bind since that side tends to be flexed in a way which moves the platelets apart. Secondly, the armour does not attempt to rely on a single layer of platelets thereby increasing security against an oblique threat and allowing the platelets in the first layer to be a little further apart thereby increasing flexibility further.

The platelets may be made of titanium, steel, ceramic or composite material or any other material which can withstand a stabbing threat.

The platelets may be mounted on opposite sides of the same sheet of flexible material or may be mounted on different sheets which are held in a fixed relationship, eg by being sewn together. Where the layers are on opposite sides of the same sheet, a platelet of each layer may be secured to the sheet of flexible material by a single fastener, eg a rivet which may be a blind rivet, which passes through holes in the first protective portions of both platelets. Alternatively, the platelets may be secured to the flexible sheet by adhesive.

The first protective portions of the platelets in the first layer may be square or rectangular in plan view and form a rectilinear array.

Preferably, in order that all the platelets in said first layer are of the same form, said second protective portions of the platelets in the first layer are generally L-shaped in plan view and project beyond a corner of the first protective portion of the platelet and beyond edges thereof which are adjacent to said corner, the second protective portion stopping short of the other corners

reached by said edges by a distance which is at least equal to the width of the second protective portion.

Preferably, in order that the platelets in the two layers may co-operate in trapping an oblique threat, the second protective portions of the platelets in the first layer and the platelets in the second layer co-operate in forming pockets arranged to trap stabbing threats passing between the platelets of the first layer obliquely of the layers. Thus, an oblique threat which passes between two platelets of said first layer becomes trapped in the pocket formed by the second protective portions of a platelet in each layer. The second layer of platelets may comprise platelets of the same form as the platelets of the first layer arranged in the same or a similar array with their second protective portions projecting on the protected side so that they underlie substantially all the gaps between the first protective portions of the second layer. Each platelet of the first layer may directly overlies a platelet of the second layer.

In order to increase the protection given by the armour, the or each flexible sheet is preferably made of woven aramid fibres. The armour may also comprise additional overlying sheets of flexible material, eg about 25 sheets of woven aramid fibre, to give the armour a bullet-proof capability.

There now follows a detailed description, to be read with reference to the accompanying drawings, of an armour which is illustrative of the invention.

In the drawings:

Figure 1 is a perspective view of the illustrative armour;

Figure 2 is a plan view of the illustrative armour, on a smaller scale than Figure 1; and

Figure 3 is a cross-sectional view taken on the line III-III in Figure 2.

The first illustrative armour 10 is for use in protecting a protected side 12 of the armour from a stabbing threat originating on an opposite threat side 14 of the armour 10. The armour 10 comprises two overlying layers of platelets, the layers being a first layer 16 which lies nearer the threat side 14 and a second layer 18 which lies nearer to the protected side 12. The layers 16 and 18 are mounted on opposite sides of the same sheet 20 of flexible material, the sheet 20 being made of woven aramid fibres.

The platelets 22 forming the first layer 16 are all of the same form and each is made from a single sheet of titanium which is 1mm in thickness. Each platelet 22 comprises a first protective portion 22a which is substantially planar and which, in plan view, is substantially square, having a side 1.7cm in length. The platelets 22 are arranged in the first layer 16 so that their first protective portions 22a lie against the sheet 20 with the portions 22a arranged adjacent to one another in a two-dimensional rectilinear array (see Figure 2). This array substantially covers the area of the armour 10. Thus, the first protective portions 22a cover a surface of the sheet 20 except for gaps 24 between the portions 22a and thereby provide protection against a stabbing threat except at the gaps 24. These gaps 24 can be considered as forming a grid surrounding square holes.

Each platelet 22 also comprises a second protective portion 22b which is integral with the first protective portion 22a. The second protective portion 22b bends out of the plane of the portion 22a towards the threat side 14



and projects, in a plane generally parallel to the plane of the first protective portion 22a, beyond the portion 22a over an edge of the first protective portions 22a of three adjacent platelets 22 in the layer 16. The portions 22b are arranged so that they co-operate in forming a grid-shaped (in plan view) cover overlying on the threat side 14 substantially all of the gaps 24 between the first protective portions 22a. Thus, the portions 22a and 22b together substantially completely cover the area of the armour. Thus, an incoming stabbing threat travelling normally of the planes of the protective portions 22a and 22b will either encounter a portion 22a or a portion 22b.

Specifically, said second protective portions 22b are generally L-shaped (see Figures 1 and 2) projecting beyond two adjacent sides of the portion 22a, thereby projecting over sides of the portions 22a of two adjacent platelets 22. The portion 22b also projects beyond the corner of the portion 22a defined by said two adjacent sides, thereby projecting above a corner portion of the first protective portion 22a of a third adjacent platelet 22. However, the portion 22b does not extend as far as the other two corners of the portion 22a reached by said adjacent sides, stopping short of them by the width of the portion 22b. The gaps left by the portion 22b stopping short of said two corners allow clearance for adjacent portions 22b to nest in and co-operate in forming the cover.

The platelets 26 forming the second layer 18 are identical to the platelets 22, having a square first protective portion 26a, and a second protective portion 26b. The platelets 26 are positioned to intercept stabbing threats passing between the platelets 22 of the first layer 16 obliquely of the layers 16 and 18.

Specifically, the platelets 26 are arranged in the second layer 18 so that their first protective portions 26a

lie against the sheet 20 with the portions 26a adjacent to one another and forming a two-dimensional rectilinear array which is the same as the array formed by the platelets 22. In fact, each platelet 26 directly underlies one of the platelets 22. Thus, the first protective portions 26a cover a surface of the sheet 20 except for gaps 28 between the portions 26a which gaps 28 underlie the gaps 24. The second protective portions 26b are spaced from the portions 26a towards the protected side 12.

The second protective portions 22b and 26b of the platelets 22 in the first layer 16 and the platelets 26 in the second layer 18 co-operate in forming pockets 32 arranged to trap stabbing threats passing between the platelets of the first layer obliquely of the layers. Such a threat might travel in the direction of the arrow 30. Such a threat might pass between two of the platelets 22 but will encounter a platelet 26. In many cases, such a threat will become trapped in said pocket.

The platelets 22 and 26 in the layers 16 and 18 are mounted on the flexible sheet 20 by means of adhesive but may, alternatively, be mounted by means of rivets. such a rivet would pass through the sheet 20 and holes located in the centre of one of the first protective portions 22a and one of the second protective portions 26a.

The armour 10 is flexible because the platelets 22 and 26 are mounted on a flexible sheet and because the platelets do not bind with one another until the armour 10 has been bent more than is normally necessary in service. Furthermore, the armour 10 provides good protection against oblique threats while employing only two layers of platelets as opposed to the three layers found necessary in some designs.

## CLAIMS

- 1 Armour for use in protecting a protected side thereof from a stabbing threat originating on an opposite threat side of the armour, the armour comprising first and second overlying layers of platelets, the first layer lying nearer to said threat side than the second layer, wherein the platelets forming said first layer each comprise a first generally planar protective portion, the first protective portions being arranged adjacent to one another in a two-dimensional array which substantially covers the area of said armour, wherein each platelet forming said first layer also comprises a second protective portion which is integral with said first protective portion of the platelet, the second protective portion projecting in a plane generally parallel to the plane of the first protective portion over an edge of the first protective portion of at least one adjacent platelet in the first layer, the second protective portions of the platelets in the first layer being arranged so that they are adjacent to one another and co-operate in forming a cover overlying on the threat side substantially all of the gaps between the first protective portions, and wherein the platelets in the second layer are positioned to intercept stabbing threats passing between the platelets of the first layer obliquely of the layers, and wherein the platelets in the two layers are secured in their relative positions by being mounted on one or more sheets of flexible material.
- 2 Armour according to claim 1, wherein the platelets are mounted on opposite sides of the same sheet.

- 3 Armour according to either one of claims 1 and 2, wherein the first protective portions of the platelets in said first layer are substantially planar.
- 4 Armour according to any one of claims 1 to 3, wherein the first protective portions of the platelets in said first layer are square or rectangular, in plan view.
- 5 Armour according to any one of claims 1 to 4, wherein said second protective portions of the platelets in the first layer are generally L-shaped in plan view and project beyond a corner of the first protective portion of the platelet and beyond edges thereof which are adjacent to said corner, the second protective portion stopping short of the other corners reached by said edges by a distance which is at least equal to the width of the second protective portion.
- 6 Armour according to any one of claims 1 to 5, wherein the second protective portions of the platelets in the first layer and the platelets in the second layer cooperate in forming pockets arranged to trap stabbing threats passing between the platelets of the first layer obliquely of the layers.
- 6 Armour according to any one of claims 1 to 5, wherein the second layer of platelets comprises platelets of the same form as the platelets of the first layer arranged in the same or a similar array with their second protective portions projecting on the protected side so that they underlie substantially all the gaps between the first protective portions of the second layer.
- 7 Armour according to claim 6, wherein each platelet of the first layer directly overlies a platelet of the second layer.

- 8 Armour substantially as hereinbefore described with reference to, and as shown in, the accompanying drawings.



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Patent  
Office

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Application No: GB 9612910.1  
Claims searched: 1 to 8

Examiner: Robert Crowshaw  
Date of search: 22 August 1996

**Patents Act 1977**  
**Search Report under Section 17**

**Databases searched:**

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK CI (Ed.O): A3V

Int CI (Ed.6): F41H 1/00, 1/02, 5/04

Other: Online database: WPI

**Documents considered to be relevant:**

Category	Identity of document and relevant passage	Relevant to claims
X	GB 2283902 A (T & N TECHNOLOGY) See especially paragraphs 3 and 4 on page 2, and figures 2 and 4.	1, 3, 4, 5, 6
X	GB 2004177 A (ELTEKA) See especially page 1 lines 79-95, and figures 1 to 3.	1, 3, 4, 6, 7
A	WO 93/10419 A1 (DOWTY) See especially the abstract, and figure 1.	
A	WO 92/13250 A1 (MUNYARD) see especially page 2 lines 26 to page 3 line 15, and figure 2.	

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.